Background

Last year, as part of the 4th Five-Year Review for the Hunters Point Naval Shipyard Site (HPNS), the Navy evaluated the remediation goals (RGs) for radiologically contaminated buildings at HPNS. Based on the evaluation, the Navy has indicated that it believes the RGs remain protective of human health for future residents and indoor workers.

In consultation with EPA Headquarters and with assistance from the U. S. Army Corps of Engineers Radiation Safety Support Team, the Region has completed a review of the Navy evaluation. We reviewed the September 30, 2019 report titled *Draft Estimated Excess Cancer Risks and Dose Equivalent Rates from Exposures to Radiological Contamination on Building Surfaces Report* ("draft building addendum") and computer files provided by the Navy presenting cancer risk estimates developed using the RESRAD BUILD (RRB) and EPA BPRG calculators. The primary purpose of our review was to determine whether we agree with the Navy's conclusion that the RGs remain protective of human health. We also examined whether EPA could support the use of RESRAD BUILD as part of the evaluation.

The Navy bases its protectiveness conclusion on its RRB analysis. The Navy does not appear to have used the BPRG results in developing its conclusion. The Navy-generated BPRG risk estimates are up to three orders of magnitude higher than the corresponding RRB risk estimates. For many radionuclides the BPRG-estimated risks far exceed the upper end of EPA's cancer risk range of 10^{-4}.

EPA Response

As part of our evaluation we wanted to understand the assumptions and methodology used to develop the RRB risk estimates and the reasons why the RRB estimates are substantially lower than the BPRG estimates. The Navy did not attempt to explain the differences in its submittals. Even after a lengthy and in-depth evaluation, we were unable to fully understand the methodology used by RRB or identify site-specific conditions that would justify the use of RRB as part of the HPNS evaluation. Therefore we cannot, at this time, support the use of RRB as part of the evaluation of HPNS building RGs or concur with the Navy's conclusion that the current building RGs remain protective of human health.

There are three primary reasons why we are unable to concur with the Navy's protectiveness determination or support the use of RRB.

First, we were unable to gain confidence in a key parameter used by RRB to calculate risk. Like the BPRG calculator, RRB uses slope conversion factors to estimate risk from a contaminated source. We understand the basis for the factors used in RRB to estimate risk dose via the external exposure pathway from various source types. We also understand the basis for the factors used in RRB to estimate risk from a source with finite thickness (i.e., a contaminated volume). However, we do not understand how RRB estimates risk from a contaminated surface (i.e., an area source) consistent with the HPNS RGs. RRB appears to use a slope factor for volumetric contamination for determining area risk, unlike the BPRG uses an external slope factor designed for area contamination to assess the risks of area contamination. This unlike how RRB conducts dose assessments for area contamination which does use the correct dose conversion factors, ground plane, similar to the EPA BDCC calculator. The HPNS RGs are defined as radionuclide concentrations per unit area (e.g., dpm/100cm2).

Commented [PW1]: I looked in the RRB users guide but do not see the term slope factor.

Commented [WS2R1]: RRB was originally dose only, which uses dose conversion factors like in the BDCC calculator. They finished up a User Guide in June 2003, then added in risk as an option later8/25/2005. So they have no text on how to use the slope factors in RRB

Commented [PW3]: Please confirm I got this right.

We searched the RRB User's Manual which was issued in June 2003 for a description of how RRB estimates risk from an area source but did not find one, which was expected since RRB did not gain the ability to conduct risk assessments until August 25, 2005. . We requested information from the Navy and directly from Argonne National Laboratory, the developer of RRB, about the slope conversion factors but received limited information in response.

Second, we were unable to conclude that the methodology used by RRB to estimate risk from contaminated dust (i.e., the removable fraction of the contamination) is sufficiently similar to EPA's approach or justified by site-specific circumstances The EPA methodology (i.e., used by the BPRG calculator) is to multiply the concentration of a radionuclide on the interior building surface by three factors: [hand-to-mouth frequency] x [fingertip surface area] x [saliva extraction factor]. The parameter values are based on an assessment of risks in buildings contaminated by the collapse of the World Trade Center. RRB uses a different methodology to estimate risk from the removable fraction of an area source, making use of a user-defined removable fraction rate, air release fraction, source lifetime, deposition rate, and ingestion rate. The parameters used in RRB and BPRG differ and cannot be directly compared. The Navy did not provide a comparison and based on our evaluation we were unable to conclude that RRB better represents conditions at HPNS, and ultimately to justify the much lower ingestion rate and risk modeled by RRB. At federal facilities, CERCLA section 120(a)(2) prohibits the use of guidelines which are inconsistent with EPA guidelines. It is also EPA policy to use consistent approaches to assess chemical and radiological risks. We are unaware of any chemical risk assessment for buildings under CERCLA that are consistent with the RRB approach. The BPRG calculator and before that the World Trade Center risk assessment have also undergone independent peer reviews, which we could not find for RRB.

Commented [PW4]: Please confirm I got this right

Commented [WS5R4]: Not sure what this sentence means

Third, the Navy's HPNS RRB simulations may underestimate risks because they assume that radiological contamination is present only on the building floor. This assumption decreases the risk estimates from external exposure to gamma radiation at HPNS buildings. We address this concern below, in our possible path forward.

Possible Path Forward

Although we are unable to support the use of RRB, we have developed a possible path forward using the BPRG calculator.

Our proposal uses a modified version of the BPRG calculator. We determined that one of the assumptions built into the online BPRG calculator may be overly conservative and inappropriate at HPNS. That is the assumption that fixed contamination is present on all six interior building surfaces. To better represent conditions at HPNS, we worked with EPA's National Superfund Radiation Expert to make use of a modified version of the BPRG calculator that assumes that any fixed contamination remaining in the buildings is limited to the floor and lower six feet of the interior walls. We assumed the 10 feet by 10 feet by 10 feetmost conservative room size, concretebuilding material, and receptor position in the most conservative position the corner of the room. We then calculated PRGs for fixed contamination for each of the 11 HPNS radionuclides corresponding to a 1 x 10-4 risk and compared the modified PRGs to the current HPNS RGs. For the residential exposure scenario, six of the current HPNS RGs (Am-241, Pu-239, Ra-226, Sr-90, Th-232, U-235) are protective for fixed contamination. Four of the current RGs (Cs-137, Co-60, Eu-152, Eu-154) would need to be reduced if the risk level is to remain

Commented [PW6]: Is that right? I used the ORNL results from the most conservative receptor position (corner) but wasn't sure about the other two factors. ORNL assumed a 10 X 10 x 10' room and concrete?

Commented [PW7]: Please confirm I got this right

below 1 x 10-4 as summarized in the table. The results from static measurements made during the Parcel G retesting would be used to show compliance with the modified RGs.

Commented [PW8]: We want to provide results at 1 x 10-4 to be consistent with our discussions about soil RGs.

	RGs for Fixed Contamination - Residential Exposure	
	Current HPNS RGs (*dpm/ 100 cm2*)	**Modified RGs at 1 x 10-4** (*dpm/ 100 cm2*)
Am-241	100	*no change*
Cs-137	5000	3650
Co-60	5000	2500
Eu-152	5000	2350
Eu-154	5000	2900
H-3	5000	*no change*
Pu-239	100	*no change*
Ra-226	100	*no change*
Sr-90	1000	*no change*
Th-232	36.5	*no change*
U-235	488	*no change*

Commented [PW9]: I converted the ORNL numbers to the same units as the current HPNS RGs

To address dust/removable contamination, we propose that the current limits for the removable fraction of the contamination (20% of the RGs) be replaced with BPRGs. The table below presents BPRGs calculated using default exposure assumptions. These are the same values included in one of the Navy's October 2019 submittals and available from the online BPRG calculator.

These PRGs are substantially lower than the current limits on the removable fraction, but we expect that the removable fraction of any radiological contamination in the HPNS buildings is low. The results of wipe samples collected during the Parcel G retesting would be used to show compliance with the modified RGs.

	Limits for Removable Contamination - Residential Exposure	
	Current Limits (20% of RGs, in *dpm/ 100 cm2*)	**Modified Limits at 1 x 10-4** (*dpm/ 100 cm2*)
Am-241	20	4.4
Cs-137	1000	149
Co-60	1000	126
Eu-152	1000	101
Eu-154	1000	204
H-3	1000	77256
Pu-239	20	4.1
Ra-226	20	1.2
Sr-90	200	51
Th-232	7.3	2.4
U-235	97.6	4.7

Commented [PW10]: Is this a usable number?

In its October 2019 submittal to EPA, the Navy included BPRG results with changes to two inputs (hand to mouth frequency and fingertip surface area). We are unable to support the Navy's proposed changes. They have not been incorporated into EPA's Exposure Factors Handbook nor are they included in planned changes to the BPRG. We reviewed the studies cited as references for the proposed changes but do not believe that the cited studies adequately support the changes.

Commented [PW11]: These statements reflect input from you and Dan Stralka, our regional toxicologist.